R-3 78 - 8

Forest Insect and Disease Conditions in the Southwest 1977

Forest Service
U.S. Department of Agriculture
Southwestern Region

Forest Insect and Disease Conditions in the Southwest 1977

compiled by
Gene Lessard

THE ZIA SUN SYMBOL tells the story of an Indian philosophy.

The figure is composed of a circle from which radiate four points. Each of these in turn is made up of four straight lines of varying length.

Four was a sacred number of Zia — the number most often used by the giver of all good gifts. The earth had four main directions, each with its own good gift. The year had four seasons, each with a different offering for mankind. The day had sunrise calling men to work, noontime when the sun was at its height, evening when day was done, and night with its darkness and rest from toil. Life had its four divisions: childhood, free from care; youth, a time of training; manhood, with its full burden of responsibility; old age, with the end of the journey near. Everything in life and nature was bound together in a circle — the circle of life and love, without beginning and without end.

And in this great brotherhood of all things man had four sacred obligations. He must develop a strong body, a clear mind, a pure spirit. Fourth, and most sacred, he must devote, unselfishly, body, mind, and spirit to the welfare of his people.

The Zia Sun Symbol appears in a field of Spanish Yellow to make up the simple but historically and artistically beautiful New Mexico flag.

Excerpted from "Spanish for Boys & Girls," N.M. Dept. of Educ. Bull. 25, Vol. 1, 1958.

Forest Insect and Disease Management
State and Private Forestry
Southwestern Region, Forest Service, USDA
517 Gold Avenue, SW
Albuquerque, New Mexico 87102

Contents

Insect and Disease Conditions 1
Conditions in Brief | 1
Status of Insects | 3
Mountain pine beetle 3
Spruce beetle 4
Western pine beetle 4
Roundheaded pine beetle 4
Engraver beetles 4
Western spruce budworm 5
New Mexico fir looper 6
White-fir needle miner 6
Douglas-fir tussock moth 7
Western tent caterpillar 7
Status of Diseases | 8
Dwarf mistletoes 8
Root diseases 9
Rusts 10
Non-biological diseases 10
Foliage diseases 11
Nursery diseases 11
Trunk rots 11
Animal damage 11
Aspen diseases 12

Forest Insect and Disease Detection 12
Detection Surveys | 12
Field Surveillance | 13

State of Arizona Insect and Disease Conditions—
State and Private Lands 14
Roundheaded pine beetle 14
Ips beetles 14
Pinyon needle scale 14
Pine tip moths 14
Southwestern dwarf mistletoe 15
Urbanization-related problems 15

State of New Mexico Insect and Disease Conditions—
State and Private Lands 15
Engraver beetles 16
Western spruce budworm 16
Douglas-fir tussock moth 16
Douglas-fir beetle 17
Pinyon needle miner 16
Mountain pine beetle 17
Western pine beetle 17

Recent Publications 17

Insect and Disease Conditions

Conditions in Brief

Bark beetles continued to cause tree losses in the Southwestern Region. Mountain pine beetle remained at low levels on the Kaibab Plateau, Ariz. In New Mexico, this insect caused widely scattered tree mortality on the Carson and Santa Fe National Forests. Spruce beetle populations in the Jemez Mountains, Santa Fe National Forest, declined markedly in 1977. The western pine beetle continued causing scattered tree losses throughout the Region. An increase in tree-killing by this insect occurred on the Kaibab and Tonto National Forests, Ariz. Widely scattered tree losses caused by the roundheaded pine beetle occurred on the Lincoln National Forest, with heavy tree losses on the adjoining Mescalero Apache Indian Reservation, N. Mex. Several engraver beetle infestations caused heavy mortality of ponderosa pine in the Southwest. The most damaging infestations were on the Coconino and Apache-Sitgreaves National Forests, Ariz., and the Gila National Forest, N. Mex.

Defoliating insects continued to damage conifers and aspen in the Southwestern Region. The most damaging of these insects, the western spruce budworm, caused visible defoliation over 197,788 acres of Douglas-fir and true firs in 1977. An operational spray project to evaluate the long-term effects of a single application of carbaryl on budworm populations during their buildup phase was conducted on the Santa Fe National Forest, N. Mex., in 1977. Population changes and the resultant tree damage will be assessed for a 3- to 5-year period in the project area. The New Mexico fir looper caused about 500 acres of heavy defoliation to Douglas-fir and white fir on the Lincoln National Forest, N. Mex. The white-fir needle miner caused light defoliation on the Apache-Sitgreaves National Forest, Ariz. The Douglas-fir tussock moth heavily defoliated 2,500 acres of Douglas-fir and true fir in New Mexico in 1977. New infestation centers were detected on the Cibola National Forest and Nambe Indian Reservation, N. Mex. A ground application of pesticides and an aerial application of the Douglas-fir tussock moth pheromone were evaluated against this insect under the Douglas-fir Tussock Moth Research and Development Program. The western tent caterpillar caused visible defoliation to aspen stands throughout the Region. A particularly heavy infestation of this insect occurred on the

Kaibab Plateau, Kaibab National Forest, Ariz. This infestation will decline in 1978.

Growth reduction and tree mortality caused by dwarf mistletoes continued throughout Southwestern forests. The simulated yield program SWYLD2 was used to quantify dwarf mistletoe losses on nearly 20,000 acres of ponderosa pine type. Surveys to collect SWYLD2 input data were completed on 12 Ranger Districts in Arizona and New Mexico. Resource managers are utilizing simulated yield tables to aid in setting treatment priorities for dwarf mistletoe-infested stands and to develop management strategies in infested stands.

Southwestern dwarf mistletoe continued to cause stand deterioration in campgrounds on several National Forests. A control project to reduce dwarf mistletoe levels in the Horsethief Basin Recreation Area, Prescott National Forest, Ariz., was initiated in 1977. Tree removal and pruning are being used to reduce adverse effects of dwarf mistletoe.

Combinations of two or three dwarf mistletoe species (Douglas-fir dwarf mistletoe on Douglas-fir, Apache dwarf mistletoe on southwestern white pine, and southwestern dwarf mistletoe on ponderosa pine), occurring in one location, resulted in continued growth loss and mortality of infested trees on the Apache-Sitgreaves National Forest, Ariz., and Cibola National Forest, N. Mex.

Root diseases caused localized losses at various locations in Arizona and New Mexico. *Armillaria mellea* root rot continued to cause tree mortality in ponderosa pine plantations throughout the Region.

Several rusts continued to damage their host trees in many parts of the Southwest. Limb rust, caused by *Peridermium filamentosum*, resulted in branch and tree mortality of ponderosa pine at several locations in the Region. Spruce and fir broom rusts remained endemic in most of the Southwest. An intense center of spruce broom rust on the North Rim in Grand Canyon National Park, Ariz., resulted in numerous spiketops in Engelmann spruce trees.

The cottonwood rust, caused by *Melampsora* sp., infected aspen and cottonwood trees at several locations in Arizona. Premature leaf drop occurred on some infected trees.

Abiotic diseases, such as salt damage, drought stress, and lightning strikes caused some tree mortality in localized areas throughout Arizona and New Mexico.

Pythium sp. and *Fusarium* sp. were found in all sampled portions of the Albuquerque Tree Nursery. Development of beds and subsequent soil fumigation will reduce fungi populations prior to 1978 seeding operations.

Containerized spruce seedlings at an Arizona nursery were damaged by a basal stem canker. Cankers developed from excessive surface soil temperature caused by overexposure to sunlight.

Echinodontium tinctorium trunk rot was prevalent on white fir trees in forest stands as well as campgrounds throughout the mixed conifer type in Arizona and New Mexico. Other trunk rots remained endemic.

Status of insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. This beetle continued to cause scattered ponderosa pine losses in the Region. In Arizona, the infestation on the Kaibab Plateau — North Kaibab Ranger District, Kaibab National Forest, and the adjoining Grand Canyon National Park — remained at about the same level as in 1976. There were no large groups of trees killed, as has occurred in the past; rather, scattered single trees or small groups (2 to 10 trees) were detected over about 100,000 acres. In New Mexico, widely scattered tree-killing occurred on the Canjilon, El Rito, Jicarilla, Penasco, Taos, and Tres Piedras Ranger Districts, Carson National Forest, and on the Espanola and Jemez Ranger Districts, Santa Fe National Forest. In 1978, all infestations are expected to remain at about the same levels as occurred in 1977.

Since all infestations were at low levels, no direct suppression was recommended. Salvage logging was recommended on some Ranger Districts, but little of the timber resource was utilized because of the high costs associated with logging of scattered dead trees. Carson National Forest personnel indicated that many of the beetle-killed trees were utilized by the public for fuelwood. They used aerial detection survey maps to show free-use wood cutters where to find dead trees.

Another small-scale evaluation of a technique to trap mountain pine beetle in recently cut ponderosa pines was made in cooperation with the Rocky Mountain Forest and Range Experiment Station. All trap trees were attacked by the beetle, which adds to successful trials done in 1975 and 1976. A pilot

project may be conducted in 1978 to evaluate this technique for reducing low-level, but not endemic, mountain pine beetle infestations in ponderosa pine.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). A 75,000-acre infestation in the highest plateaus and mesas of the Jemez Mountains declined markedly in 1977. Santa Fe National Forest personnel on the Cuba, Coyote, and Espanola Ranger Districts carried out sanitation and salvage timber sales of about 20.5 MMBF of infested and susceptible Engelmann spruce during the infestation.

Elsewhere in the Region, only small isolated groups of spruce beetle-killed trees were detected during aerial surveys. Tree mortality was found on the Apache-Sitgreaves and Coronado National Forests and Fort Apache Indian Reservation of Arizona.

Western pine beetle, *Dendroctonus brevicomis* LeC. Scattered ponderosa pine, singly and in small groups, were killed by this bark beetle over portions of all forests in the Southwest. The level of tree losses was about the same as in 1976, except for increased pine mortality on the Chalender Ranger District, Kaibab National Forest, and the Globe Ranger District, Tonto National Forest, Ariz. Salvage was recommended where concentrations of dying pines were accessible.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. Ponderosa pine mortality from this insect continued in 1977 on the Lincoln National Forest and Mescalero Apache Indian Reservation, N. Mex., and Coconino National Forest, Ariz. In general, tree losses were widely scattered with heaviest tree losses in the upper portions of the Pine Tree Canyon drainage, Mescalero Apache Indian Reservation. Pole-size trees are most commonly attacked by this insect. Since there are few markets in this area for pole-sized material, opportunities for salvaging infested trees have been limited.

Engraver beetles, *Ips* spp. Several engraver beetle infestations caused heavy mortality of ponderosa pine in the Southwest. The most damaging infestations were on the Flagstaff and Elden Ranger Districts, Coconino National Forest; Luna Ranger District, Gila National Forest; and Springerville and Alpine Ranger District, Apache-Sitgreaves National Forest. Successive years of timber and fire management programs in ponderosa pine stands had created slash and weakened or killed

pines which caused the *Ips* outbreaks. Sapling and pole-size trees were attacked and killed in these stands.

A suppression project was conducted on the Springerville Ranger District to kill beetle broods in infested slash. A combination of slash treatments was used: piling and covering slash with clear plastic to create lethal temperatures by a "greenhouse effect," hand and machine piling of slash and burning of the piles, and chipping of the slash.

Regional entomologists are working with resource managers to prevent engraver beetle outbreaks. When possible, managers are encouraged to schedule timber and fire programs to stop creating slash or weakened trees year after year in a pine stand. Also, they can reduce the chances of an outbreak by doing thinning and cutting programs from July through October to allow slash to dry and become unsuitable for beetles that fly in the spring. Thorough slash disposal programs were encouraged in many areas to prevent buildups. Training sessions are being conducted to promote field surveillance by forest workers. Finally, increased efforts will be made to have entomologists participate in the preparation and review of management plans and environmental statements to insure that there is adequate consideration of *Ips* prevention and suppression measures.

Western spruce budworm, *Choristoneura occidentalis* Free. Budworm infestations increased for the third consecutive year. Defoliation was visible over 197,788 acres in 1977, compared with 123,760 acres in 1976. Budworm populations have reached epidemic proportions on the Kaibab Plateau, Kaibab National Forest, Ariz., and the Carson, Santa Fe, Cibola, and Gila National Forests in New Mexico. Egg mass densities increased over 1976 levels on most Forests, and at least moderate defoliation is forecast for 1978 on all these Forests. Suppression was not recommended for any of these infestations.

An operational spray project to evaluate the long-term effects of a single application of carbaryl on a budworm population during the buildup phase was conducted in 1977. Carbaryl was aerially applied by helicopter (fig. 1) over about 37,500 acres of the Jemez Mountains, Santa Fe National Forest, N. Mex. An area of similar size (40,000 acres) was established in the Jemez Mountains as an untreated check unit.

Unadjusted larval mortality on the treatment unit was 93.1 percent. Budworm larval populations in the untreated unit dropped 44.5 percent due to natural control factors.

Percent defoliation in the treated unit for Douglas-fir and white fir was 26.4 and 37.0 respectively, while percent defoliation for the untreated unit for these two tree species was 40.8 and 61.1, respectively. This represents a savings of foliage in the year of spray of 14.4 percent for Douglas-fir and 24.1 percent for white fir.

Population changes and the resultant tree damage will be assessed in each unit for a 3- to 5-year period.

The Lama 315B helicopter with underslung bucket (fig. 1) performed unsatisfactorily on this project. Manual hookup of the bucket system also presented a safety hazard.

Fig. 1. Lama 315B helicopter with underslung bucket.

New Mexico fir looper, *Galenara consimilis* Hein. Approximately 500 acres of heavily defoliated stands of Douglas-fir and white fir were detected in Bonito Creek, Smokey Bear Ranger District, Lincoln National Forest, in 1977. This insect causes considerable defoliation for two to three years and then populations quickly collapse. Tree mortality and top-kill is expected to be minimal. Suppression was not recommended.

White-fir needle miner, *Epinotia meritana* Hein. Several infestation centers of this insect were detected on the Alpine and Springerville Ranger Districts, Apache-Sitgreaves National

Forest. The infestation occurred in the same areas that were defoliated from 1971-74. The defoliation is light in most areas and tree damage should be minimal.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.). Defoliation of 2,500 acres of Douglas-fir and true firs occurred in 1977. New outbreak centers were found on the Sandia Ranger District, Cibola National Forest; Cochiti Canyon, Tesuque Ranger District, Santa Fe National Forest; and in Nambe Canyon, Nambe Indian Reservation, N. Mex. Infestations in Trigo Canyon and Canyon del Agua, Cibola National Forest, are declining and will continue this trend in 1978.

Population assessment studies, utilizing larval sampling and pheromone trapping, indicated a decrease in number of larvae in Arizona and southern New Mexico. Larval populations continued to increase in Los Alamos, Pueblo, and Medio Dia Canyons in northern New Mexico.

Entomologists from Region 2, working under the Douglas-fir Tussock Moth Research and Development Program, conducted ground application tests against tussock moth larvae in Medio Dia Canyon, Tesuque Ranger District, Santa Fe National Forest, in 1977. The chemical pesticides evaluated were Dimilin® 25 WP, Orthene® 75S, Sevin® 50 WP, and Pyrocide Growers Spray. Test results indicate these insecticides are effective in reducing larval populations with no significant differences between insecticides. Biological pesticides evaluated include several formulations of *Bacillus thuringiensis* (Dipel® WP, Thuricide® 16B, and Biotrol® 16K) and a baculovirus preparation, "TM-Biocontrol-1". The *Bacillus thuringiensis* formulations were effective in reducing larval populations and preventing excessive defoliation. Virus results indicate additional formulation testing is needed.

Western tent caterpillar, *Malacosoma californicum* (Pack.). Heavy defoliation to aspen stands on the North Kaibab Ranger District occurred in 1977. An egg mass survey conducted in October 1977 indicated that these populations are declining. Light defoliation is predicted for 1978 as populations continue to collapse.

Visible defoliation occurred on the Apache-Sitgreaves National Forest and Fort Apache Indian Reservation, Ariz., and the Santa Fe, Carson, and Gila National Forests, Bandelier

National Monument, and Santa Clara Indian Reservation, N. Mex.

Tent caterpillar infestations usually persist for two to three years and quickly decline. Damage to affected stands rarely reaches a point where control is needed. Though branch mortality can be excessive, little tree mortality normally occurs.

Status of Diseases

Dwarf mistletoes. Dwarf mistletoe continued to be the most destructive forest disease in the Southwest. Annual timber volume losses caused by dwarf mistletoe exceed half the annual allowable cut in Region 3. The most damaging species are: southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Weins, on ponderosa pine, Douglas-fir dwarf mistletoe, *A. douglasii* Engelm., on Douglas-fir, western spruce dwarf mistletoe, *A. microcarpum* (Engelm.) Hawks. and Weins, on Engelmann spruce, and Apache dwarf mistletoe, *A. apachecum* Hawks. and Weins, on southwestern white pine.

Implementation of the simulated yield program SWYLD2 continued. This program provided resource managers with an estimate of timber volume loss caused by dwarf mistletoe in ponderosa pine. About 20,000 acres of mistletoe-infested ponderosa pine were surveyed for input in the SWYLD2 program. Surveys were completed on 12 Ranger Districts in 6 National Forests (Apache-Sitgreaves, Carson, Cibola, Kaibab, Santa Fe, and Tonto).

A new survey procedure for collecting SWYLD2 input data and a data summary program (SWSUMMARY) were designed and tested in 1977. The SWSUMMARY program prepares stand summary tables and calculates SWYLD2 stand condition variables from survey data. Information provided by SWYLD2 simulated yield tables aids the resource manager in management of dwarf mistletoe-infested stands.

Southwestern dwarf mistletoe caused stand deterioration in campgrounds on the Coconino, Kaibab, and Prescott National Forests. Control recommendations were developed for each campground. A mistletoe control project was initiated in the Horsethief Basin Recreation Area, Prescott National Forest. All trees with dwarf mistletoe ratings of 3 or above have been marked for removal in three campgrounds and the adjacent travel

influence zone. Lightly infected trees in the campgrounds will be pruned to reduce buildup of mistletoe in residuals.

The occurrence of several species of dwarf mistletoe in one area caused substantial losses in mixed conifer type on Alpine Ranger District, Apache-Sitgreaves National Forest, Ariz., and Magdalena Ranger District, Cibola National Forest, N. Mex. Species involved were southwestern dwarf mistletoe on ponderosa pine, Douglas-fir dwarf mistletoe on Douglas-fir, and Apache dwarf mistletoe on southwestern white pine. Removal of class 3 and above (6-class rating system) trees was recommended.

Spittlebugs were feeding on southwestern dwarf mistletoe plants in several locations on the Apache-Sitgreaves National Forest (fig. 2). Mortality of some aerial shoots was observed, but effects were very localized.

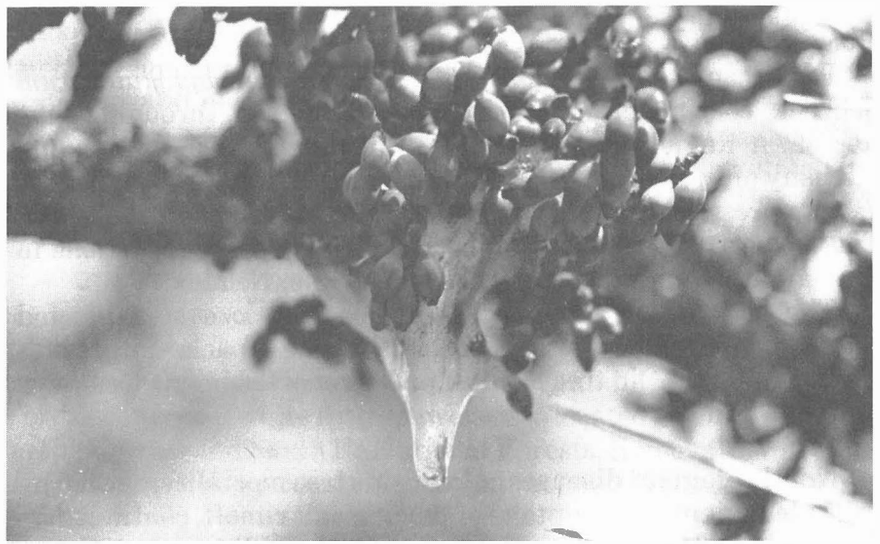

Fig. 2. A mass of spittle from spittlebugs on a southwestern dwarf mistletoe plant.

Root diseases. *Armillaria mellea* Vahl. ex. Fr. continued to cause mortality in ponderosa pine plantations throughout the Region. Highest mortality losses were observed in plantations on the Santa Fe National Forest. This root rot usually functions as a natural thinning agent, but may become a serious pathogen in plantations and other areas where trees are under stress.

Phaeolus (Polyporus) schweinitzii (Fr.) Pat. was associated with windthrow of ponderosa pine in a campground on the Coconino National Forest. Removal of infected trees and stumps was recommended to reduce safety hazard for campground users.

Rusts. Limb rust, caused by *Peridermium filamentosum* Pk., resulted in branch mortality and limited tree mortality in sawtimber-size ponderosa pine on the Coconino, Gila, Kaibab, and Santa Fe National Forests. Ponderosa pine trees in Grand Canyon National Park also were infected. Limb rust, in combination with twig borers, caused branch and tree mortality in sapling size ponderosa pine trees on a portion of the Kaibab National Forest. This occurrence is somewhat unusual, as the disease is most frequently observed in large ponderosa pines.

Spruce broom rust, caused by *Chrysomyxa arctostaphyli* Diet., remained at an endemic level in most spruce-fir forests of the Southwest. A particularly intense infection center of spruce broom rust was located on the North Rim of the Grand Canyon in Grand Canyon National Park. Numerous mature spruce trees had dead tops, resulting from broom rust infection. Also, some tree mortality was present in the infested area.

Fir broom rust, caused by *Melampsorella caryophyllacearum* Schroet., continued to intensify in white fir trees throughout the Region. A Regionwide survey to determine the distribution and intensity of fir broom rust is planned in 1978. Resource managers have expressed concern about management of this forest disease. Fir broom rust continued to increase in endemic proportions in the Sandia Mountains, east of Albuquerque, N. Mex.

The cottonwood rust, caused by *Melampsora* sp., infected cottonwood trees in several locations on the Apache-Sitgreaves National Forest. No tree mortality was reported in any locations.

Non-biological diseases. Roadside tree mortality, caused by chloride toxicity from uptake of deicing salt runoff, continued on the Cibola and Santa Fe National Forests. In addition, decline and mortality of roadside trees bordering Bandelier National Monument (New Mexico State Highway 4) was attributed to chloride toxicity. Affected species were ponderosa pine, Douglas-fir, and white fir.

Numerous lightning-struck trees were observed on the Kaibab National Forest and in Grand Canyon National Park. Affected trees often had dead or dying tops, while others were broken off at a lower point in the crown. Various insects were associated with damaged trees.

Drought stress was not a significant mortality factor in the Southwest during 1977.

Foliage diseases. Foliage diseases remained endemic throughout the Southwest.

Nursery diseases. Prior to development of nursery beds at the Albuquerque Tree Nursery, a survey was made to determine population levels of *Pythium* spp. and *Fusarium* spp. Both pathogenic fungi were found in all 20 soil samples. Fungal concentrations varied from low (*Pythium* + 1.6 prop./g.; *Fusarium* + 240 prop./g.) to high (*Pythium* + 101.2 prop./g.; *Fusarium* + 7,120 prop./g.) throughout the nursery site. Development of beds and subsequent soil fumigation will reduce fungi populations prior to 1978 seeding operations.

Containerized spruce seedlings from the Bureau of Indian Affairs Nursery at McNary, Ariz., were damaged by basal stem cankers. Cankers were caused by excessive temperature of the surface soil. Control recommendations included shading of seedlings and north-south orientation of rows.

A buildup of green algae at the Southwestern Handicapped Services Nursery near Silver City, N. Mex., was related to improper irrigation and high temperatures. Application of an algicide was recommended to alleviate the problem.

Trunk rots. *Echinodontium tinctorium* (E. & E.) E. & E., on white fir trees, was frequently encountered in forest stands on the Apache-Sitgreaves, Carson, Cibola, and Kaibab National Forests. Infected white fir trees were also located in campgrounds on the Kaibab and Santa Fe National Forests. Removal of infected trees in the campgrounds was recommended for safety hazard reduction.

Other trunk rots remained endemic throughout the Region.

Animal damage. Rodent girdling of ponderosa pine trees in several plantations on the Santa Fe National Forest continued in 1977. Annual mortality in these plantations appears to be decreasing. As planting stock increases in size, rodent girdling will continue to decrease.

Deer browsing caused tip damage, resulting in forked tops, on aspen and ponderosa pine seedlings in several areas of the Region.

Elk "barking" wounds were particularly prevalent on aspen trees in the Carson National Forest. These wounds do not appear to adversely affect aspen trees.

Aspen diseases. Work continued on a cooperative study (Region 2 and Rocky Mountain Forest and Range Experiment Station) evaluating pathological effects of various logging practices on residual aspen trees. All trees (972) on 11 study plots in New Mexico and Colorado were examined in 1977. Residual tree mortality varied from 0 to 21 percent of the leave basal area. Primary mortality causes were *Cenangium singulare* (Rehm.) Davids. & Cash., *Ceratocystis fimbriata* Ell. & Halst., windthrow, and sunscald. A final evaluation of all plots will be completed in 1979-80.

Premature leaf drop, resulting from infection by *Melampsora* sp., caused complete defoliation of aspen trees in one location on the Kaibab National Forest.

Aspen trees in several locations on the Fort Apache Indian Reservation were infected with *Marssonina populi* (Lib.) Magn. The disease caused premature leaf drop, and severe defoliation occurred in one area.

Forest Insect and Disease Detection

The frequency of occurrence of insect and disease outbreaks and their location cannot be accurately predicted. Early discovery of outbreaks is a task which no single agency can do alone. Thus, discovery of outbreaks has developed into a cooperative undertaking with two distinct phases. The first phase is a program of planned, systematic surveys, called detection surveys. A second, equally important phase is field surveillance undertaken by forest workers in connection with their regularly assigned duties.

Detection Surveys

A primary role of survey entomologists is to insure prompt discovery of outbreaks. Both aerial and ground survey techniques are used.

Aerial surveys are used when insect-caused damage can be seen by an observer in a low-flying aircraft. Generally, these surveys will be organized in a well-planned, systematic manner to insure all visible damage is detected.

In 1977, a total of 14.2 million acres were aerially surveyed in Arizona and New Mexico from July through September:

State	Ownership	Acres (millions)
Arizona	National Forest	5.1
	National Park Service	0.1
	Indian Lands	1.8
	Other Federal[1], State, and private	0.1
New Mexico	National Forest	5.6
	Indian lands	0.5
	Other Federal[1], State, and private	1.0

[1]Other Federal ownership includes Bureau of Land Management, National Monuments, Department of Energy, and U.S. military installations.

Aerial survey information is not only useful to entomologists, but resource managers can use it in their work. As a result, maps showing infestations are sent to resource managers each year after the survey has been completed for their respective administrative units. This information can be used to plan salvage sales, show free-use firewood collectors where to find dead trees, and for many other uses.

Field Surveillance

All forest workers should be on the alert for forest insect and disease outbreaks in conjunction with their normal field activities. Timber cruising, stand improvement, trail maintenance, fire reconnaissance, and other activities afford excellent opportunities for forest workers to discover outbreaks before they become visible from the air. Land managers or owners share the responsibility for discovery of outbreaks on forested lands they manage. There are too few survey entomologists and pathologists to discover all outbreaks on a timely basis.

Prompt reporting of new outbreaks is of the utmost importance to insure early follow-up. Any form of communication is permissible, but the Forest Service and the New Mexico Department of Agriculture have sent detection forms and kits to land managers to speed the reporting process.

In 1977, 51 detection report forms (R-3 5200-5) were received by FIDM. In general, the information provided on the forms was adequate for prompt and accurate determinations to be made. A common error was not providing all possible information in the

"General Information" and "Tree Damage Symptoms" section — particularly the host tree species. Also, the "Remarks" section at the bottom of the form should be reserved for FIDM response. Additional comments about a particular problem were helpful to FIDM in making determinations. These comments should be included whenever possible, but they should be placed on a separate sheet of paper and attached to the back of form R-3 5200-5.

REMEMBER — PEST DETECTION IS FOR YOUR PROTECTION. Be alert!

State of Arizona Insect and Disease Conditions — State and Private Lands

by Robert Celaya

Roundheaded pine beetle, *Dendroctonus adjunctus.* Widely scattered pole-size ponderosa pines were killed by this beetle on private land in Flagstaff, Payson, and Lakeside. Removal and proper disposal of infected trees was recommended where applicable.

Ips beetles, *Ips* spp. Ponderosa and pinyon pine losses on private land, caused by ips beetles, increased in 1977. Most of the damage occurred due to stress placed on trees by construction. Any technique that destroys the infested material was recommended, i.e., piling and burning (where safe and legal), burial at local landfill, or, if utilized for firewood, covering with clear, heavy polyethylene plastic. Covering infested material with plastic prevents adult emergence and causes larval mortality due to a buildup of temperatures under the plastic.

Pinyon needle scale, *Matsucoccus acalyptus.* Pinyon needle scale damage continued to decrease in 1977 in Prescott, Arizona. Although very early reports of scale emergence were received, snowstorms in late winter apparently reduced the level of damage evidenced in spring. Cultural and chemical control of these pests was prescribed. Cultural control involves washing the eggs from the trunk and branches of the tree, bagging eggs and debris washed off, and disposing of it.

Pine tip moths, *Rhyacionia spp.* These pests were evidenced in Flagstaff and the Showlow-Lakeside-Pinetop area.

Most of the damage occurred along roads and highways and on individual ornamental trees. Pruning and burning of infested tips was advised.

Southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptopodum.* Southwestern dwarf mistletoe on ponderosa pine caused the greatest impact on private forested lands. Subdivisions near Pinetop, Arizona, contained high infection levels. Silvicultural measures to reduce dwarf mistletoe levels were recommended. Silvicultural treatment involves removal of heavily infested trees and pruning of infected branches where infection levels are low to moderate.

Urbanization-related problems were one of the most significant factors causing tree mortality on private lands. Trunk wounds, soil compaction, and root damage were prevalent. Weakened trees were more susceptible to bark beetle attack.

State of New Mexico Insect and Disease Conditions — State and Private Lands

by Tony Smith

Defoliating insects increased noticeably on State and private lands in northern New Mexico. Tree damage and losses have been minimal, but are expected to increase in 1978. Increasing western spruce budworm populations caused light to very heavy defoliation over greatly increased acreages on private lands in northeastern New Mexico. Infestations of western tent caterpillar continue to defoliate aspen stands completely for the third straight year, but refoliation was fairly complete by late June. Douglas-fir tussock moth populations declined in two areas and expanded in four other areas, including the county lands in Los Alamos where moderate to complete defoliation occurred on approximately 1,200 acres. A chronic infestation of pinyon needle miners continues to defoliate about 2,400 acres of pinyon west of Taos. Most trees show extreme branch flagging, with only current growth remaining.

Other insects causing noticeable damage to trees in New Mexico include a twig-boring beetle, pine tip moth, pitch nodule moth, bark moths, fall webworm, tiger moths, twig gall flies, and resin midges (*Camptomyia* sp.).

Major tree losses on 791,000 acres of private land, east of the

Carson National Forest, were caused by bark beetles, especially in areas with two consecutive years of low precipitation. Mountain pine beetle, western pine beetle, and Douglas-fir beetle continue to kill scattered single trees and small groups of trees throughout northern New Mexico, particularly decadent trees or those on dry sites. No spruce beetle infestations were discovered on State or private lands in 1977.

Engraver beetles (*Ips* spp.). These beetles continue to be a problem in areas of pinyon being developed into residential subdivisions and in high-use recreation areas.

Western spruce budworm, *Choristoneura occidentalis* Free. Visible defoliation by this insect increased from 4,000 acres in 1976 to more than 26,000 acres in 1977. The major infestation of approximately 24,000 acres is centered on the Philmont Scout Ranch, near Cimarron, with about 6,000 acres showing moderate to heavy damage. Similar defoliation is expected in 1978, but suppression was not recommended since egg mass densities were lower than expected.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.). Chronic infestations in ornamental spruce, true fir, and Douglas-fir continue in Santa Fe and Los Alamos. The population in and around Los Alamos has increased greatly on county and Federal lands. Light to complete defoliation occurred on approximately 1,200 acres. A suppression project for 1978 is being planned with cooperation among personnel of Region 3 FIDM, New Mexico Department of Agriculture, New Mexico Department of State Forestry, and the County of Los Alamos. About 700 ornamental trees within the city limits will be sprayed along with the 1,200 acres of forested canyon bottoms which dissect the city. Ornamentals will be sprayed with ground rigs using a chemical (Sevimol®, Dibrom®, or Sevin®-4-oil), and the canyons will be treated with helicopter-applied nucleopolyhedrosis virus (NPV).

New populations were discovered with the use of pheromone-baited detection traps in northeastern New Mexico. Averages of nine moths per trap and 16 moths per trap were caught on Vermejo Park property and Philmont Scout Ranch, respectively. Surveys will be conducted in May 1978 to determine population densities in these two areas.

Pinyon needle miner, *Coleotechnites* n. sp. This insect has remained very active on about 2,400 acres of pinyon about 20 miles

☆ U.S. GOVERNMENT PRINTING OFFICE: 1978 — 782-686 REGION NO. 8

west of Taos. First noticed in 1973, the miner continues to cause moderate to heavy defoliation. Many trees now have dying twigs and branches. Most trees retain only 1-year-old foliage and/or partial 2-year-old foliage. Some tree mortality has occurred in the area due to insect damage, 2 to 3 years of drought, and hail damage in 1973.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Widely scattered, single decadent trees and small groups of mature ponderosa were killed by this beetle on private ownerships near Brazos and Cimarron. Where practical, around summer homesites, removal or utilization of infested trees was recommended. Trees were felled and debarked, the bark was burned, and the wood was used for firewood.

No major outbreaks were discovered during aerial survey. Mortality of scattered older trees is expected to continue in northern New Mexico.

Western pine beetle, *Dendroctonus brevicomis* LeC. Scattered ponderosa pines were killed by this beetle throughout most of New Mexico. Single trees of groups of 5 to 25 trees were detected on poor and/or dry sites. One small infestation, near La Cueva, of about 30 acres declined of natural causes and the efforts of private landowners to remove infested trees. Further attacks in the area are not expected in 1978.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. This beetle killed groups of 50 to 350 Douglas-fir trees on the Vermejo Park property. The widely scattered infestations occurred in canyon bottoms over 485,000 acres following two years of extremely dry conditions. Drought effects were halted in 1977 by an unusually wet year. These insects generally follow periods of drought and are expected to decline greatly in 1978. Inaccessibility prevents any attempts at salvaging operations.

Recent Publications

New Mexico Department of Agriculture; Forest Service, USDA; New Mexico Department of State Forestry; and Cooperative Extension Service, USDA. 1977. Insects and diseases of evergreens in New Mexico. 21 pp.

Walters, J.W., and N.R. Walters. 1977. *Verticicladiella wageneriii* in the Southwest. Plant Dis. Rep. 61: 419.

NATIONAL FORESTS IN ARIZONA AND NEW MEXICO